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FEDERALLY SPONSORED ENERGY RESEARCH IN THE NORTHERN GREAT PLAINS-NORTH DAKOTA FY 1976

June, 1977

ENVIRONMENTAL PROTECTION AGENCY
ROCKY MOUNTAIN - PRAIRIE REGION
REGION VIII

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In August 1976, the U.S. Environmental Protection Agency, in cooperation with the State of Montana, established the EPA Montana Energy Operations Office. The challenge of this office is to develop an effective mechanism for transferring energy research results from the laboratory to the decision-makers. As a way to fulfill part of this challenge, a survey was initiated in the Fall of 1976 to summarize the federal energy effort in the State of North Dakota. This report is a summary of the information obtained from numerous state and federal publications. Recommendations regarding further actions on various aspects of energy research are included. The report serves primarily as an informative document to inform researchers, state and federal government officials, and decision-makers at all government levels how and where the federal energy research dollar is being directed in North Dakota.

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FEDERALLY SPONSORED ENERGY RESEARCH IN THE NORTHERN GREAT PLAINS

NORTH DAKOTA

FY 1976

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U.S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF ENERGY ACTIVITIES
REGION VIII
DENVER, COLORADO 80295

June 1977

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ABSTRACT

In August 1976, the U. S. Environmental Protection Agency, in cooperation with the State of Montana, established the EPA Montana Energy Operations Office. One objective of this office is to develop an effective mechanism for transferring energy research results from the laboratory to the decision-makers in the Northern Great Plains. As a way to fulfill part of this challenge, a survey was recently initiated to summarize the federal energy effort in the State of North Dakota. This report is a summary of the information obtained from numerous state and federal publications. Recommendations regarding further actions on various aspects of energy research are included. The report serves primarily as an informative document to inform researchers, state and federal government officials, industry, and decision-makers at all government levels how and where the federal energy research dollar is being directed in North Dakota.

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CONTENTS

		Page
Abstract		ii
Acknowledgements		iii
List of Tables		v
Abbreviations		vi
SECTIONS		
I.	Overview.	1
II.	Introduction	3
III.	Results	6
IV.	Conclusions and Recommendations	7
V.	References	27

TABLES

No.		Page
1.	National Energy R&D Federal Expenditures	9
2.	Federally Sponsored Energy Research Relating to North Dakota	10
3.	Air Quality/Meteorology	11
4.	Alternative Sources	12
5.	Biological (Fish, Vegetation, and Wildlife)	13
6.	Coal	14
7.	Economics	15
8.	Energy Policy	16
9.	Geology and Soils	17
10.	Governmental Studies	18
11.	Land (Use, Ownership, and Reclamation)	19
12.	Resource Allocation	23
13.	Sociological Studies	24
14.	Water Quality	25
15.	Water Use/Supply	26

ABBREVIATIONS

CEQ	Council of Environmental Quality
EPA	U. S. Environmental Protection Agency
ERDA	U. S. Energy Research and Development Administration
NRC	Nuclear Regulatory Commission
NSF	National Science Foundation
OWRC	Old West Regional Commission
USDA	U. S. Department of Agriculture
USDI	U. S. Department of the Interior

1. OVERVIEW

Since the Arab oil embargo of late 1973, the energy situation of the United States has been the focus of much analysis and comment. The importance of energy to the nation was real long before this point of public and government revelation. The significance of energy in the American life style has been steadily increasing over the past several decades. For example, gross U.S. energy demand has risen at about 4 percent a year since 1950 until 1973 (U.S. Department of the Interior, 1975). Similarly, for many years electric power demand grew at an annual rate of about 7 percent (U.S. Federal Energy Administration). While the growth rate for electricity fell to about 1 percent in 1974, and in 1975 to 2 percent (U.S. Department of the Interior, 1975), the demand for both gross energy and electricity increased by mid-1976 markedly over 1975 levels (Environmental Quality Council, 1976). National gross energy consumption has fluctuated over the last three years and projections through the year 2000 show an average exponential increase of 2.91 percent per year over the 1972 levels (72.2 quadrillion BTU), (U.S. Energy Research and Development Administration, 1975).

Despite a probable lower rate of growth in U.S. energy consumption during the next quarter century, there probably will be substantial changes in the physical forms, geographic sources and means of production of U.S. energy supplies by the year 2000 (Federal Energy Administration, February 1976). With greater dependence on coal, the Northern Great Plains Region will experience greater development pressures (Nehring, 1976). In excess of 1.5 trillion

tons of coal are estimated to lie at all depths within the Region. About 10 percent of this total amount is actually measured, or at least strongly indicated by local measurements, and is also mineable. This amount equals 160 billion tons and presently represents 37 percent (by weight) of the Nation's coal reserve base. Of this 160 billion tons, half is located within areas where mining by surface methods is feasible (Montana 42.6 billion tons; North Dakota 16.0 billion tons; South Dakota 0.4 billion tons; and Wyoming 21.2 billion tons (Northern Great Plains Resources Program, February 1974). Besides these vast quantities of coal, it is the relatively low cost combined with low sulfur content by weight (in comparison to eastern coals) that attracts the coal industry towards the West.

The coal resource is extensive. It provides an alternative fuel for use of increasingly scarce natural gas and increasingly costly residual fuel oil by electrical utilities. However, its use is not without problems. The mining, transport and conversion of coal may have several adverse effects on the environment . In addition, socio-economic effects (boom town and bust) indirectly impact local areas as well as state institutional systems through population changes associated with developments in each phase of the coal fuel cycle.

It is the public concern for the health, environmental, social and welfare impacts of energy-related activities that has become a critical factor in defining the growth trajectory for domestic energy production. These public concerns are directed at observable as well as suspected deleterious aspects of the discovery, extraction, transport and conversion of fuels, as well as their ultimate use.

During the next several years, the nation will be faced with a series of critical energy-related decisions of utmost priority and importance. The need for increasing the nation's energy supply must be balanced against the need for

minimizing environmental impacts caused by energy production. Any environmental program that is implemented must provide to the nation the basic understanding necessary to project, evaluate, and monitor environmental effects and to suggest appropriate control technology. Successful implementation of an environmental research program will affect all aspects of the energy self-sufficiency program and will be a significant determinant of ultimate energy resource use and development patterns.

The ultimate limitation to resource development is the amount of environmental degradation that the American people are willing to accept for secure, abundant energy supplies. The principal intermediate constraints are the availability of capital and materials, the availability and selection of suitable sites, the economic, social and environmental costs of power generation and delivery systems, the relative efficiencies and availability of alternative energy sources, the availability of effective resource management systems, and the state of pollution control and abatement technologies.

Rational and effective decision-making concerning future coal supply and demand options will depend greatly upon the application of science and engineering to forecast the amount and kinds of effects that will result from various energy production and use options.

II. INTRODUCTION

As a result of a national need for assessing the impacts of various energy-producing activities on the environment, the federal government has launched an extensive energy research program. In FY '76, (July 1, 1975-June 30, 1976), the federal government spent approximately $300 million (Energy Research

and Development Administration, 1976) in research and analysis for the specific purpose of assessing the impacts of various energy producing activities on the environment. Table 1 summarizes the total FY '76 and FY '77 federal effort. Results from various energy-related projects are now beginning to be published by the federal agencies who are sponsoring these activities. Recognizing the need for transferring the results of these studies to decision-makers, this report attempts to identify the federally-funded energy research projects that relate to the State of North Dakota. Federal research dealing with technology development was included in the survey. It is anticipated that as new technology breakthroughs occur, appropriate environmental assessment activities will be sponsored to assess possible environmental impacts.

The extensive research information systems established by the North Dakota Regional Environmental Assessment Program (REAP) and the Old West Regional Commission (Old West Regional Commission, 1975) provided the momentum for initiating this search to identify how and where the federal research dollar is being directed in North Dakota. The accuracy and completeness of these information systems are susceptible to error, but it is believed these information data bases are reasonably comprehensive. Those studies that are carried out over a several state area are identified and appropriate funding levels are listed.

Information describing ongoing, federally-funded North Dakota energy research is organized as follows:

Air Quality/Meteorology (baseline monitoring),

Alternate Sources (solar, wind, geothermal, small-scale hydro power),

Biological (fish, vegetation and wildlife),

Coal (conversion and new technologies),

Economics (impacts on local economics),

Energy Policy,

Geology and Soils,

Governmental Studies (impacts on local governments),

Land (use, ownership and reclamation),

Resource Allocation (energy conservation and fuel substitution),

Sociological Studies,

Water Quality (baseline monitoring and impact degradation),

Water Use/Supply (allocation, diversion, water rights).

The Old West Regional Commission and the North Dakota Regional Environmental Assessment Program (REAP) monitor the energy research that is being sponsored by the federal government, the State of North Dakota, industry, university system, and the combination of state and federal government, and industry and federal government. Their sources of energy research information include university research offices, individual researchers, state agencies, federal agencies, Smithsonian Science Information Exchange, Oakridge National Laboratory Energy Information Center, North Dakota Congressional delegates, newspaper and newsletter articles, and industry.

III. RESULTS

Tables 2-15 summarize the federal effort in North Dakota. Because the state does have vast resources of coal, a substantial amount of the federally-sponsored research does deal with the development of coal and with ameliorating the effects associated with this development. For example, of the total energy research dollars spent during FY '76 on research relating to North Dakota by the U. S. Government ($7.9M), 39.6 percent was associated with coal technology development projects. Land reclamation activities comprised 20.6 percent of the total resources. Resource allocation received 9.7 percent of the total funds that the federal government spent on energy research projects. Water quality and water use/supply research received 5.8 percent and 0.4 percent, respectively. Air quality/meteorology studies received 1.3 percent, biological research received 3.8 percent, and sociological studies were funded at 2.1 percent.

The Energy Research and Development Administration provided approximately 43.2 percent of the federal funds for energy research relating to North Dakota. Most of this research was associated with coal technology development projects. The United States Department of the Interior provided 16.5 percent of the federal energy research funds, and committed a majority of its resources toward land reclamation, geology and soils and water quality investigations. The Old West Regional Commission (13.1 percent) devoted a majority of its resources to governmental studies and land reclamation. The Environmental Protection Agency (9.2 percent) directed most of its resources towards energy policy and water quality monitoring research. The United States Department of Agriculture (5.8 percent) directed its research toward land reclamation and biological assessment of energy development activities.

IV. CONCLUSIONS AND RECOMMENDATIONS

As anticipated, the Environmental Protection Agency is involved in assessing environmental impacts of energy activities in the State of North Dakota. The Energy Research and Development Administration is directing a majority of its efforts toward coal-oriented technology development. The United States Department of the Interior is heavily involved in land reclamation, geology and soils and water quality monitoring. The United States Department of Agriculture is directing its research mostly toward land reclamation and biological assessments. While the federal government research has been heavily directed toward engineering and physical and biological monitoring, there has been inadequate research sponsored by the federal government in the socio-economic area. This low level of federal effort may reflect a lack of any one federal agency having clear responsibility for assessing the socio-economic impacts. It may also reflect the lack of a clear cut federal responsibility for assisting energy-impacted communities and rural populations. In addition, it may reflect that presently socio-economic factors in the environmental impact statement procedure are not as well developed as biological and physical characterization.

It is also apparent that federal sponsored research in North Dakota dealing with air quality/meteorology, alternative sources (renewable energy supplies), economics, energy policy, geology and soils, water use/supply, and sociological studies is at a low level of funding relative to technology development. In order to complement State programs in these areas, additional resources may need to be directed toward some of these areas.

The question of how this information is integrated and then provided to the decision-makers at the local, state and national level is a challenge that all in

the energy research area are going to have to face. Presently, agencies are working toward developing computerized data systems that allow the decision-makers to gain access to the collected information. However, the development of such a data base should be viewed as a first step toward achieving an efficient transfer of research information from the data generator through the data formatter to the data user. As more experience is gained in assessing the quality and quantity of the research energy information, it is anticipated that more comprehensive information transfer systems can be created. The energy decisions that Northern Great Plains states, such as the State of North Dakota, will have to face over these coming years will be very critical to regional development as well as the national energy supply. The research activities that are being sponsored by the federal government will play a major role in providing the data that assists the states and the national government in making these major decisions. The challenge to the federal government is how to establish a viable information system that will allow the decision-makers to astutely apply the research data and results that are presently being generated.

Table 1

National Energy R&D Federal Expenditures

Agency	FY '76 $(M)	FY '77 $(M)
ERDA	1800.0	2413.0
USDI	150.0	161.5
EPA	120.0	120.0
NRC	86.0	103.2
NASA	1.0	0.8
NSF	74.2	106.9
Total	2231.2	2905.4

Source: Energy Research and Development Administration, "A National Plan for Energy Research, Development, and Administration: Creating Energy Choices for the Future 1976", Volume 2, P. XVII.

Table 2

FEDERALLY SPONSORED ENERGY RESEARCH RELATING TO NORTH DAKOTA
$(K) -- FY '76

	NSF	USDA	EPA	USDI	ERDA	OTHER	TOTAL	PERCENT
Air Quality/Meteorology	—	--	50	—	11	41	102	1.3
Alternative Sources	--	--	--	--	--	26	26	0.3
Biological	—	157	79	12	—	55	303	3.8
Coal	—	--	--	—	3,135	--	3,135	39.6
Economics	—	20	92	--	--	109	221	2.8
Energy Policy	--	--	239	3	155	--	397	5.0
Geology and Soils	--	--	--	250	--	--	250	3.2
Governmental Studies	--	--	--	--	--	432	432	5.4
Land	--	282	54	752	88	454	1,630	20.6
Resource Allocation	—	--	--	--	--	767	767	9.7
Sociological Studies	--	--	--	36	31	96	163	2.1
Water Quality	30	--	213	220	--	--	463	5.8
Water Use/Supply	--	--	--	33	--	--	33	0.4
Total	30	459	727	1,306	3,420	1,980	7,922	100.0
Percent	0.4	5.8	9.2	16.5	43.2	25.0	100	

Table 3

AIR QUALITY / METEOROLOGY

Project Title	Sponsoring Agency	$(K)	Investigator
Ground-Level Measurements of Nuclei from Coal Development in Northern Great Plains: Work Plans for Design of a Monitoring Program 1/	OWRC/ERDA	16/11	B. Davis, S. D. School of Mines and Tech.
A Study of Power Plant Plumes to Determine Their Composition, Transport and Dispersion and Evaluate the Potential for Possible Modification of Weather on the Mesoscale 2/	OWRC	25	J. Marwitz, University of Wyoming
Baseline Ambient Air Quality Monitoring at Eight Sites	EPA	50	G. Christianson, N. D. State Health Dept. Bismarck, N. D.

1/ Total project funded at $50K/$35K.
2/ Total project funded at $75K.

Table 4

ALTERNATIVE SOURCES

Project Title	Sponsoring Agency	$(K)	Investigator
Review Report — Missouri River — North Dakota, South Dakota, Nebraska, and Montana 3/	Corps of Engineers	26	C. Garvey, U.S. Corps of Engineers, Omaha, Nebraska

3/ Total project funded at $133K.

Table 5

BIOLOGICAL (FISH, VEGETATION & WILDLIFE)

Project Title	Sponsoring Agency	$(K)	Investigator
Impact of Coal Development on Plant Ecosystems in Western North Dakota	USDA	11	D. Galitz, North Dakota State University
Trace Element Effects of Energy Conversion Facilities	OWRC	55	G. Christianson North Dakota State Department of Health
Effect of Grazing on Vegetation and Soils of Reclaimed Land and on Animal Performance	USDA	146	L. Hofmann, Northern Great Plains Research Center, Mandan, North Dakota
An Evaluation of the Environmental Impact of the Existing Surface Mining Methods for Western Coal Mines 4/	EPA	58	W. Kelley, Mathematica, Inc., Princeton, New Jersey
Health Impacts of Environmental Pollution in Energy-Development Impacted Communities 5/	EPA	9	M. Goodwin, Copley International Corporation, La Jolla, California
Prediction of the Effects of Energy Development on the Aquatic Resources of Two Upper Missouri River Reservoir Ecosystems 6/	USDI/EPA	12/12	B. Nelson, U.S. Fish and Wildlife Service, Pierre, South Dakota

4/ Total project funded at $173K.
5/ Total project funded at $54K.
6/ Total project funded at $25K/$25K.

Table 6

COAL

Project Title	Sponsoring Agency	$(K)	Investigator
Slagging Fixed-Bed Coal Gasification	ERDA	600	R. Ellman, ERDA, Grand Forks Energy Research Center, Grand Forks, North Dakota
Control of Ash Fouling in Combustion of Western Coals	ERDA	250	E. Sondreal, ERDA, Grand Forks Energy Research Center, Grand Forks, North Dakota
SO_2 Removal Using Ash-Alkali Wet Scrubbing	ERDA	250	E. Sondreal, ERDA, Grand Forks Energy Research Center, Grand Forks, North Dakota
Premium Fuels from Northern Great Plains Lignite: Project Lignite	ERDA	91[illegible]	D.E. Severson, University of North Dakota, Engineering Experiment Station, Grand Forks, North Dakota
Removal of Fly Ash from Stack Gases by Electrostatic Precipitation	ERDA	200	E. Sondreal, ERDA, Grand Forks Energy Research Center, Grand Forks, North Dakota
Coal Liquefaction by the Co-Steam Process	ERDA	400	E. Sondreal, ERDA, Grand Forks Energy Research Center, Grand Forks, North Dakota
A Comparative Study of Effluents and their Control from Four Dry Ash Lurgi Gasification Plants	ERDA	99	M. Somerville, University of North Dakota
Chemistry of Lignite Liquefaction	ERDA	55	V. Stenberg, University of North Dakota
Study of Oxygen Stoichiometry and Analysis of Coal, Lignite, and their Derivatives	ERDA	365	A. Volborth, North Dakota State University

Table 7

ECONOMICS

Project Title	Sponsoring Agency	$(K)	Investigator
Demonstration Program for Servicing the Occupational Needs of Emerging and Expanding Business and Industry in North Dakota	OWRC	36	T. Renner, North Dakota State Board for Vocational Education
Economics of Coal and Oil Shale Development on Environmental Quality in Rural Areas 7/	EPA/USDA	92/20	USDA, Economic Research Division, Washington, D. C.
Western Regional Energy Development Study -- Phase III -- Socio-economic Impacts and Secondary Impacts 8/	CEQ	73	J. Gilmore, University of Denver

7/ Total project funded at $460K/$100K.
8/ Total project funded at $293K.

Table 8

ENERGY POLICY

Project Title	Sponsoring Agency	$(K)	Investigator
Technology Assessment of Western Energy Resource Development 9/	EPA	217	J. White, University of Oklahoma
Impacts of Synthetic Liquid Fuels Development 10/	ERDA	55	E. Dickson, Stanford Research Institute, Menlo Park, California
Laws Relating to Wildlife and Energy Development 11/	USDI	3	R. Beck, University of North Dakota
Information Transfer System: User/User Needs Survey	EPA	15	B. Johnson, Director Regional Envrionmental Assessment Program, Bismarck, N. D.
Information Transfer System: User/User Need Survey	EPA	7	N. D. League of Cities
Regional Studies Program 12/	ERDA	100	J. Hoover, Argonne National Laboratory, Argonne, Ill.

9/ Total project funded at $1,300K.
10/ Total project funded at $275K.
11/ Total project funded at $15K.
12/ Total project funded at $800K.

Table 9

GEOLOGY & SOILS

Project Title	Sponsoring Agency	$(K)	Investigator
Geochemical Survey of the Western Coal Regions 13/	USDI	250	J. Connor, USGS, Denver, Colorado

13/ Total project funded at $500K.

Table 10

GOVERNMENTAL STUDIES

Project Title	Sponsoring Agency	$(K)	Investigator
North Dakota Impact Assistance Program	OWRC	432	North Dakota Planning Division Bismarck, North Dakota

Table 11

LAND (USE, OWNERSHIP, AND RECLAMATION)

Project Title	Sponsoring Agency	$(K)	Investigator
North Dakota Reclamation Study	OWRC	420	Steve Moran, North Dakota Geological Survey
Reclamation of Spoils Resulting from Surface Mining of Lignite	USDA	50	J.J. Bond, USDA, Northern Great Plains Research Center, Mandan, North Dakota
Species Response to Salt Levels and Soil Texture	USDA	25	J.F. Power, Northern Great Plains Research Center, Mandan, North Dakota
Development of Perennial Grass Species Adapted for Use in Strip-Mine Reclamation	USDA	10	J.J. Bond, Northern Great Plains Research Center, Mandan, North Dakota
Reclamation of Strip-Mine Spoils Related to Gypsum and Topsoil Additions at Major Mining Sites in Western North Dakota	USDA	20	J.J. Bond, Northern Great Plains Research Center, Mandan, North Dakota
Selection and Increase of Woody Plants for Mine Spoils in the Northern Great Plains	USDA	10	W.C. Whitman, North Dakota State University
Reclamation of Strip-Mined Land as Affected by Depth of Surface Soil and Subsoil Returned	USDA	25	J.J. Power, Northern Great Plains Research Center, Mandan, North Dakota
The Effects of Various Depths of Topsoil Added to Sodic Coal Mine Spoils on Grass Establishment and Growth	USDA	10	J.J. Bond, Northern Great Plains Research Center, Mandan, North Dakota
Utilization of Amendments, Topsoil, and Mulches to Improve Sodic Spoil Materials	USDA	5	J.J. Bond, Northern Great Plains Research Center, Mandan, North Dakota

Table 11 Cont'd.

LAND (USE, OWNERSHIP, AND RECLAMATION) CONT'D.

Project Title	Sponsoring Agency	$(K)	Investigator
Effect of Nitrogen, Phosphorus, and Vegetative Mulch on Grass Establishment	USDA	5	J.J. Bond, Northern Great Plains Research Center, Mandan, North Dakota
Spoil Materials in Relation to Their Original Depth as a Medium for Grass Growth	USDA	10	J.J. Bond, Northern Great Plains Research Center, Mandan, North Dakota
Methodology for Collecting and Analyzing Spoil and Overburden Samples	USDA	15	F. Sandoval, Northern Great Plains Research Center, Mandan, North Dakota
Effects of Placement and Topsoil Depth on Crop Growth, Rooting, and Availability on Coal Mine Spoil Materials	USDA	25	G. Reichman, North Dakota State University
Evaluation of Leaching Waters on Hydraulic Conductivity of Sodic Spoils and on Calcium Exchange Efficiency	USDA	20	E. Doering, Northern Great Plains Research Center, Mandan, North Dakota
Establishment of Range Grasses on Disturbed Land Using Irrigation	USDA	25	R. Ries, Northern Great Plains Research Center, Mandan, North Dakota
Project Reclamation: A Systems Approach to Mined Land Reclamation	USDI	420	A. Kollman, University of North Dakota
Characterization of Physical and Chemical Properties of Spoils 14/	USDA	10	F. Sandoval, Northern Great Plains Research Center, Mandan, North Dakota

14/ Total project funded at $90K.

Table 11 Cont'd.

LAND (USE, OWNERSHIP, AND RECLAMATION) CONT'D.

Project Title	Sponsoring Agency	$(K)	Investigator
Preliminary Evaluation of Strip-Mine Spoils and Methods for Their Vegetation 15/	USDA	7	F. Sandoval, Northern Great Plains Research Center, Mandan, North Dakota
Energy Minerals Rehabilitation Inventory and Analysis-EMRIA 16/	USDI	274	R. Kuhlman, U.S. Bureau of Land Management, Denver, Colorado
Land Reclamation Laboratory Programs 17/	ERDA	88	R. Carter, Argonne National Laboratory, Argonne, Illinois
Trend-Surface Analysis of Powder River Basin, Wyoming, Wyoming-Montana, and Williston Basin, North Dakota 18/	USDA	3	T. Yamamoto, Forest Research Lab., South Dakota School of Mines and Technology
Reconnaissance Techniques for Evaluation of Rehabilitation Potential of Energy Resource Lands 19/	USDI	33	L. Shown, USGS, Denver Colorado
Determination of Optimum Topsoil Depth Requirements for Surface Coal-Mined Areas Within the Northern Great Plains Coal Province: Reclamation 20/	USDI	25	R. Barth, Colorado School of Mines, Golden, Colorado
Agricultural Use of Waste Gypsum from Sulfur Scrubbing Operation 21/	OWRC	34	J. Skaptason, Biosearch and Development Company, Kansas City, Missouri

15/ Total project funded at $20K.
16/ Total project funded at $821K.
17/ Total project funded at $175K.
18/ Total project funded at $5K.
19/ Total project funded at $164K.
20/ Total project funded at $152K.
21/ Total project funded at $134K.

Table 11 Cont'd.

LAND (USE, OWNERSHIP, AND RECLAMATION) CONT'D.

Project Title	Sponsoring Agency	$(K)	Investigator
Development of a Simulation Model for Evaluation of Surface Mining Operations and Reclamation Plans 22/	USDA	4	D. Gibson, Montana State University
Effects of Different Rehabilitative Treatment Methods on Surface Runoff Quantity and Quality and Erosional Behavior of Surface Mine Spoils in the Intermountain West 23/	USDA	3	P.E. Packer, Forestry Science Laboratroy, Logan, Utah
Effects of Surface Configuration in Water Pollution Control 24/	EPA	54	R. Hodder, Montana State University

22/ Total project funded at $13K.
23/ Total project funded at $80K.
24/ Total project funded at $269K.

Table 12

RESOURCE ALLOCATION

Project Title	Sponsoring Agency	$(K)	Investigator
Yellowstone River Basin and Adjacent Coal Area Level "B" 25/	U.S. Water Resources Council	767	K. Corrigall, Missouri River Basin Commission

25/ Total project funded at $2,300K.

Table 13

SOCIOLOGICAL STUDIES

Project Title	Sponsoring Agency	$(K)	Investigator
Human Impacts of Energy Development: A Panel Design	USDI	36	R. Ludtke, University of North Dakota
Construction Worker Profile 26/	OWRC	13	J. Chalmers, Mountain West Research, Inc., Denver, Colorado
Assessment of Temporary and Mobile Public Facilities for Impacted Communities 27/	OWRC	9	M. Richard, Howard, Needles, Tammen and Bergendoff Inc., Minneapolis, Minnesota
Indian Lignite Manpower Project 28/	U. S. Department of Commerce	74	D. Myers, United Tribes Education Technology Center, Bismarck N. D., D. Schwartz, North Dakota State University
Community Service and Land Use Impacts of Energy Facilities 29/	ERDA	31	L. Susskind, MIT Cambridge, Massachusetts

26/ Total project funded at $75K.
27/ Total project funded at $45K.
28/ Total project funded at $104K.
29/ Total project funded at $125K.

Table 14

WATER QUALITY

Project Title	Sponsoring Agency	$(K)	Investigator
Hydrologic Changes Due to Lignite Mining in North Dakota -- Part 1 -- Reconnaissance of Strip-pable Lignite Deposits	USDI	170	O. Crosby, USGS, Bismarck, North Dakota
Water Quality and Biological Monitoring Program for Energy Resource Areas -- North Dakota	EPA	24	USGS, Bismarck, North Dakota
Water Quality Impacts of Surface Coal Mining in Southwestern North Dakota	EPA	11	W. Scott, USGS, Bismarck North Dakota
The Inventory and Distribution of Water and Associated Land Resources in the Garrison/Devils Lake Region of North Dakota: An Application of Resource Data Acquired by ERTS	USDI	32	R. Mower, North Dakota State University
Terrestrial Heat Flow in the Williston Basin	NSF	30	F. Howell, University of North Dakota
Water Resources Aspects of Coal Transportation by Slurry Pipeline 30/	USDI	18	J. Moore, Water Resources Research Center, Fayetteville, Arkansas
A Cooperative Program to Evaluate Surface and Ground Water Problems Associated with Potential Strip Mine Sites 31/	EPA	178	R. Koob, P. Rechard, T. Williams, North Dakota State, University of Wyoming, Montana State University , and Montana College of Mineral Sciences and Technology

30/ Total project funded at $55K.
31/ Total project funded at $629K.

Table 15

WATER USE / SUPPLY

Project Title	Sponsoring Agency	$(K)	Investigator
Availability of Ground Water from Aquifers in the Cretaceous and Tertiary Systems in the Fort Union Coal Region 32/	USDI	28	M. Croft, USGS, Bismarck, North Dakota
Hydrologic Effects of Surface Mining Land Rehabilitative and Land Use as Defined by Rainfall Simulation 33/	USDI	3	G. Lusby, USGS, Denver, Colorado
Water Conservation on Rangelands and Mine Spoils of the Northern Plains 34/	USDI	2	G. Schuman, U.S. ARS, Cheyenne, Wyoming

32/ Total project funded at $70K.
33/ Total project funded at $35K.
34/ Total project funded at $6K.

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